Tectono-metamorphic evolution of the Eo-Alpine extrusion wedge in the Eastern Alps (Oberhof window, Carinthia, Austria)

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During the Eo-Alpine collisional event, eclogite-bearing nappes were exhumed in an extrusion wedge that corresponds to the core of the Upper Austroalpine Unit of the Eastern Alps. Towards the foot- and hanging wall of the wedge, the metamorphic field gradient decreases. As there is little modern P-T-t-D data for low and medium-grade metamorphic units available, their geodynamic significance during burial and exhumation is not well constrained. A suitable area for targeting this open question is the tectonic window of Oberhof (Carinthia, Austria), since the transition between medium-grade and low-grade units is exposed.

A revised map and profile including a consistent stratigraphic and tectonic nomenclature of units in the Oberhof window are presented. Late Ordovician orthogneiss overlain by conspicuous garnet-chloritoid bearing graphite schist, quartzite and dolomite marble corresponding to the Bundschuh Nappe (BN, Ötztal-Bundschuh Nappe System) are exposed in the core of the window. Garnet- and hornblende-bearing schist corresponding to the Gstoder Nappe (GN, Koralpe-Wölz NS) are found structurally above, unlike elsewhere in the Upper-Austroalpine unit east of the Tauern Window. 4 zones with upward increasing phyllonitization are identified within this unit. The window boundary on top is defined by a top-to-the-E shear zone. The hanging wall is comprised by chloritic phyllites and quartzites of the basal parts of the Drauzug-Gurktal NS.

Based on field- and microstructural observations, several deformation events result in the following (micro)structures: (D1) tight folds with strong scattering axes roughly trending E-W to SE-NW, (D2) ductile top-E shearing in the upper part of the section and (D3) shallow-dipping, top-E/ESE normal faults at brittle-ductile conditions. Folding (D1) results in the most pervasive imprint and occurred closely after metamorphic peak conditions. Since it overprints older boundaries related to nappe-stacking (D0) no kinematic indicators of nappe-stacking are preserved and transitions between units are ambiguous. Cross-cutting relationships show that D1 and D2 occurred at least partly contemporaneously. Pseudosection modeling for two garnet-(chloritoid) bearing samples with neglectable retrograde overprint yield ~550°C and ~9kbar for both BN and GN. Simple zoned garnets exhibiting slight decrease of Mn indicates single-phase metamorphism. Raman spectroscopy of carbonaceous material infer metamorphic peak temperatures around 520°C throughout the whole succession.

We suggest that fluid-driven retrogression related to the D2 and D3 top-E shearing events is responsible for the retrogression gradient of peak assemblages as reflected by progressive disappearance of garnet. Rb-Sr cooling ages of biotite around 75 Ma imply a minimum age for this event. Due to the common post-peak history observed in the structurally deeper units, we interpret large scale folding around peak temperature conditions to account for the reversed position of the GN and BN. A conceptual geodynamic model that addresses the geodynamic significance of the transition to the Drauzug-Gurktal NS is presented.